MODEL 550L
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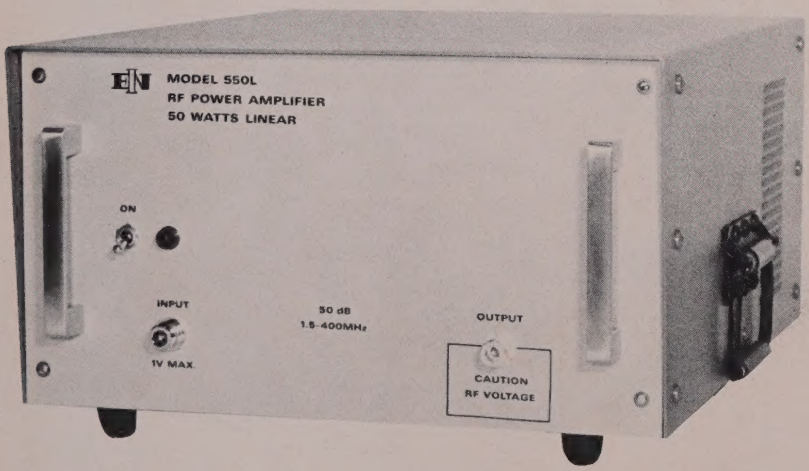
# ELECTRONIC NAVIGATION INDUSTRIES, INC.

## INSTRUCTION MANUAL

- ENI

## MODEL 550L

## BROADBAND POWER AMPLIFIER

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# WARRANTY

Electronic Navigation Industries, Inc. warrants each instrument to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing and replacing any defective parts for a period of one (1) year after delivery to the original purchaser.

When warranty service is required, the instrument must be returned transportation charges prepaid to the factory or our authorized service facility. If, in our opinion, the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before work is started.

There are no other warranties expressed or implied, including any warranty of merchantibility or fitness. Seller shall not be responsible for any incidental or consequential damages arising from any breach of warranty.

# CONTENTS


## CHAPTER 1 GENERAL INFORMATION

1.1 Introduction . . . . . 1
1.2 Data Summary . . . . . 1

## CHAPTER 2 OPERATION

2.1 Introduction . . . . . 3
2.2 Rack Installation . . . . . 3
2.2.1 Mains Voltage Setting . . . . . 3
2.2.2 Mains Fuse Rating . . . . . 4
2.2.3 Mains Lead Connection . . . . . 4
2.3 Operation . . . . . 4

## CHAPTER 3 TECHNICAL DESCRIPTION

3.1 General Description . . . . . 5

## CHAPTER 4 MAINTENANCE

4.1 Introduction . . . . . 7
4.2 Access and Layout . . . . . 7
4.3 Performance Checks . . . . . 8
4.3.1 Initial Check . . . . . 8
4.4 Re-alignment Procedure . . . . . 9
4.4.1 Measurement of Gain . . . . . 9
4.4.2 Measurement of Harmonics . . . . . 10
4.5 Packaging for Reshipment . . . . . 11

## CHAPTER 5 SCHEMATIC AND PARTS LIST

5.1 Schematic Diagram . . . . . 12
5.2 Parts List . . . . . 12
5.3 List of Manufacturers . . . . . 12
5.4 Ordering Replacement Parts . . . . . 12

# CHAPTER 1 GENERAL INFORMATION

## 1.1 INTRODUCTION

The Model 550L is a general purpose broadband amplifier capable of more than 50 watts of linear power output when driven by any laboratory signal or sweep generator from 1.5 to 400 MHz.

An ultra linear Class A design, the 550L will "boost" the output of any signal source by a flat 50 dB (±1.5 dB) and provide its full forward output power into any load impedance (from an open to a short circuit). Its output is a faithful reproduction of the input waveform for AM, FM, SSB, CATV, pulse and other complex modulations. Although specified only over the 1.5 to 400 MHz frequency range, full power output is typically available from 1 to 420 MHz.

The use of stud mounted UHF transistors on microstrip circuit boards makes the 550L both reliable and easy to service. An integral power supply and cooling system permits operation over a wide range of temperature and AC line conditions.

## 1.2 SUMMARY

| | |
|---|---|
| Frequency Coverage: | 1.5 to 400 MHz |
| Gain: | 50 dB nominal |
| Gain Variation: | ±1.5 dB |
| Maximum Linear Power Output: | More than 50 watts |
| Harmonic Distortion: | All Harmonics greater than 23 dB below the fundamental at 50 watts output. Lower distortion at reduced power. |
| Input/Output Impedance: | 50 ohms |
| Input VSWR: | 1.8 Maximum |
| Output VSWR: | 2.8 Maximum |
| Stability: | Unconditionally stable |
| Typical 3rd Order Intermodulation Intercept Point: | +59 dBM |
| Noise Figure: | 12 dB |

| | |
|---|---|
| Power Requirement: | 115/230V a.c. ±8% 50-60 Hz, at 1,200 watts |
| Size and Weight: | 15.5 x 19.7 x 8.5 inches, 58 lbs.<br>39.4 x 50.1 x 21.6 cm, 26.3 Kg |
| Operating Temperature: | $0^{o}$ to $45^{o}$C |
| Protection: | Unit will withstand a +16 dB overdrive (1 volt RMS) for all output load conditions, including short and open circuits. |
| Output Connectors: | Type "N" |
| Rack Mounting: | Adaptors provided |

# CHAPTER 2 OPERATION

## 2.1 INTRODUCTION

The ENI 550L RF amplifier is used to increase the r.f. output level of signal sources in the 1.5 to 400 MHz range. No tuning or any other form of adjustment is required other than the selection of the correct power line (AC) input voltage.

The 550L produces rated power output at its output connector, regardless of load impedance. Any power reflected due to output load mismatch is absorbed in the amplifier. Therefore, although the output impedance is 50 ohms (typical VSWR: 2:1), the amplifier will work into any load impedance.

## 2.2 RACK INSTALLATION

Rack mounting brackets are supplied with the 550L for installation in any standard nineteen inch relay rack cabinet. To attach the brackets to the 550L, remove the three #8-32 screws on each side of the cover nearest the front panel and reinsert them through the corresponding holes in the brackets. Tighten securely. The bottom feet may be unscrewed and removed if the minimum vertical usage of the relay rack is necessary.

### 2.2.1 Mains Voltage Setting

The supply voltage selection terminal block TB1 is located at the front of the instrument. The voltage setting is determined by the location of the jumper on this terminal strip.

Accommodating the unit to the available AC line voltage is accomplished by connecting the jumpers to the correct terminals of the terminal strip TB1 in accordance with table 2-1.

Disconnect the line cord from the power main when adjusting the operating voltages. Failure to connect jumpers to their proper terminals may result in severe damage to the instrument.

Table 2-1. Line Voltage Connections

| NOMINAL LINE VOLTAGE | JUMPERS | |
|---|---|---|
| | WHITE | BLACK |
| 115 VAC | 1-2 | 3-4 |
| 230 VAC | 2-3 | REMOVE |

### 2.2.2 Mains Fuse Rating

The mains fuse F1 is located on the rear panel. The replacement part number details are:

15 amp Slow Blow ENI Part No. 313015

The 15 amp rating is correct for both 115 and 230 volts a.c.

### 2.2.3 Mains Lead Connection

For 230V a.c. operation, a suitable mains supply plug must be fitted to the mains lead attached to the instrument. The three conductors are coded as follows:

BLACK – Live
WHITE – Neutral
GREEN – Earth

## 2.3 OPERATION

Determine and adjust the voltage setting as described in the previous sections 2.2.1 and 2.2.2 then proceed as follows:

(i) Ensure input RF voltage from the signal source is not excessive.

The 1 V rms indicated maximum input voltage is 5 times the level of the input signal required to achieve maximum output. Input voltages in excess of 2 volts peak may permanently damage the instrument.

(ii) Connect the input signal via a 50 ohm coaxial lead to the input connector.

(iii) Connect the output via a 50 ohm coaxial lead to the load.

# CHAPTER 3 TECHNICAL DESCRIPTION

## 3.1 GENERAL DESCRIPTION

The ENI Model 550L is designed to amplify signals by 50 dB in the frequency range of 1.5 to 400 MHz. The signal from the front panel type N connector is fed by a length of 50 ohm coaxial cable to the input of the preamplifier module (550L-3711). The signal from the input of the preamplifier is fed to a pi network attenuator R1, R2, and R3 (see figure 5.1). The output of the attenuator is fed to the base of input transistor Q1. The gain flatness of this low noise stage is adjusted by variable capacitor C4. The output of transistor Q1 is fed via capacitor C5 to the base of transistor Q2 which is similarly adjusted for gain flatness via capacitor C8. Additional amplification is picked up in transistors Q3 and Q4. The output of transistor Q4 is transformer coupled through T1 to the base of driver transistor Q5. The power output of driver transistor Q5 is split through a four way multicoupler consisting of transformers T2, T3, an d T4 and fed to four coaxial connectors mounted at the side of the preamplifier chassis.

The outputs of the four driver lines are fed through 50 ohm coaxial cables to the input of the 550L-4712 power amplifier modules. The input signal at each of the four modules is matched and attenuated by resistors R1, R2, and R3 and fed to transformer T1 which is an input matching transformer. Capacitors C2, C40, and C41 match the reactive impedance of transistor Q1 to the primary of transformer T1. The output of transistor Q1 is split into four equal amplitude and phase components by transformers T2, T3, and T4. Transformers T5, T6, T7, and T8 serve to reduce the driving point impedance at the base of transistors Q2, Q3, Q4, and Q5 respectively. Additional impedance matching for transistor Q2 is provided by capacitors C7, C8, C11, and C12. Capacitors C15, C16, C21, and C22 provide matching for transistor Q3. In addition, capacitors C23, C24, C27, and C28 provide matching for Q4 while C31, C32, C35, and C34 provide matching for transistor Q5. Resistors R16, R25, R34, and R43 provide negative feedback to level and match the gain of the output power stages. The output power stages are matched by transformers T9, T10, T11, and T12. The equal phase and amplitude output power is then coupled through hybrid transformers T13, T14, and T15 to the output transformer T16. Additional output impedance matching is provided by capacitors C37 and C38.

The output power of each power amplifier module is fed via 50 ohm RG178 cable to the inputs of the output combiner module 550L-3712. The four inputs are mounted on right angle connectors at the top of the amplifier chassis. Hybrid transformers T4, T3, T2, and T1 serve to combine and isolate the outputs of the four individual power amplifier modules. Matching is provided by capacitors C1, C2 and C3. The output of the combiner module is fed by a 50 ohm coaxial cable to the front panel type N connector.

The 550L power requirements are 115V or 230VAC at approximately 1,200 watts. Each of the two power supply regulator modules 550L-4713 provide a regulated 26.4 volts DC at up to 12 amperes DC. Short circuit protection is provided in each of the series regulators and is adjusted by potentiometers R14 and R15. Transistors Q2, Q3, Q4, Q5, Q6, Q7, Q8, and Q9 provide the series pass elements in a Darlington arrangement. Integrated circuits IC1 and IC2 provide the regulated output voltage which is fed to transistors Q1 and Q10 respectively. Resistors R7 and R17 individually adjust the regulated output voltage. The front panel light is connected to the 26.4 volt DC supply and indicates when the power supply is operating.

## 4.3 PERFORMANCE CHECKS

To determine the amplifier's performance carry out the following procedure.

### 4.3.1 Initial Check

The following check can be made after repair and adjustment or whenever the condition of the unit is in question.

(i) Connect AC power line. Switch on power and observe that the supply lamp (DS1) illuminates.

(ii) Connect a sweep generator (Wavetek 2001 or similar) capable of sweeping the frequency range 1.5 to 400 MHz to the input connector.

(iii) Adjust the output level of the sweep generator so that a 50 ohm video detector connected at the output of the unit will not be damaged by excessive power output.

(iv) Observe the gain versus frequency ripple on an oscilloscope calibrated in decibels. The gain variation must be not more than ±1.5 dB over the frequency range.

(v) Connect a calorimetric power meter (HP434 or equivalent) in series with a 10 dB, 75 watt attenuator (Engleman Microwave) to the output connector. Adjust the input signal to any convenient frequency between 1.5 and 400 MHz so that the meter indicates 50 watts of output.

(vi) Observe the harmonic distortion of the output on a spectrum analyzer (HP8554L or equivalent). The harmonic components contributed by the amplifier should be at least 23 dB down from the fundamental. Make certain that the signal fed to the spectrum analyzer is sufficiently attenuated to avoid damage to its front end.

If the requirements of this check are not met, verify that:

(a) The mains supply switch and fuse are correctly selected and that DS1 is illuminated.

(b) The preamplifier and power amplifier voltages are set for 26.4 VDC by R7 and R17 on the regulator modules.

If above checks are found to be correct, then normal fault location procedures, with reference to the circuit diagram Figure 5.1 should be followed to determine the correct operation of the preamplifier and power amplifier modules.

# CHAPTER 4 MAINTENANCE

## 4.1 INTRODUCTION

The ENI 550L RF amplifier requires no periodic maintenance. The instrument is unconditionally stable and is failsafe under all load conditions. Damage can only be externally caused by the incorrect selection of the supply voltage or by an input signal in excess of the specified 1 volt rms maximum.

This chapter therefore, deals only with certain fundamental procedures for fault location and with the subsequent re-alignment procedures.

Performance limits quoted are for guidance only and should not be taken for guaranteed performance specifications unless they are also quoted in the Data Summary Section 1.2.

## 4.2 ACCESS AND LAYOUT

The ENI model 550L is housed in an aluminum chassis. The cover may be removed by releasing the eight screws on each side of the unit.

The lamp indicator on the front panel may be replaced by unscrewing the lens cover and removing the lamp.

The rear panel supports the mains fuseholder, and the cooling fan.

The preamplifier module, output combiner module, two P.A. heatsink (two power amplifier modules per heatsink), and two regulator modules mounted on the inside of each P.A. heatsink form the "inverted U" shaped RF horseshoe.

To gain access to any of these modules, first remove its associated coaxial cables, power connections and hardware. The module is then free for removal. To adjust each of the 26.4 VDC power supplies lift the snap plug at the top of the left or right P.A. heatsink depending on the supply to be adjusted. This will expose the voltage adjust potentiometer R7 and R17.

To gain access to the preamplifier sweep adjustment, remove its cover located at the top front of the unit by releasing six #4-40 phillips head screws.

The two power supply transistor assemblies are mounted to the bottom of the chassis located in the center of the RF horseshoe.

## 4.4 RE-ALIGNMENT PROCEDURE

Before any adjustment is made to the unit, first

(i) Ensure that the mains switch and fuse are correctly selected and that DS1 is illuminated.

(ii) Measure the power supply voltages and adjust per section 4.3.1. (b).

### 4.4.1 Measurement of Gain

Equipment required:

(a) Oscilloscope – Tektronix Model T921
(b) Sweep/Signal Generator – Wavetek 2001
(c) 50 ohm Detector – Wavetek D151
(d) Attenuator, 10 dB, 75 watts – Engleman Microwave

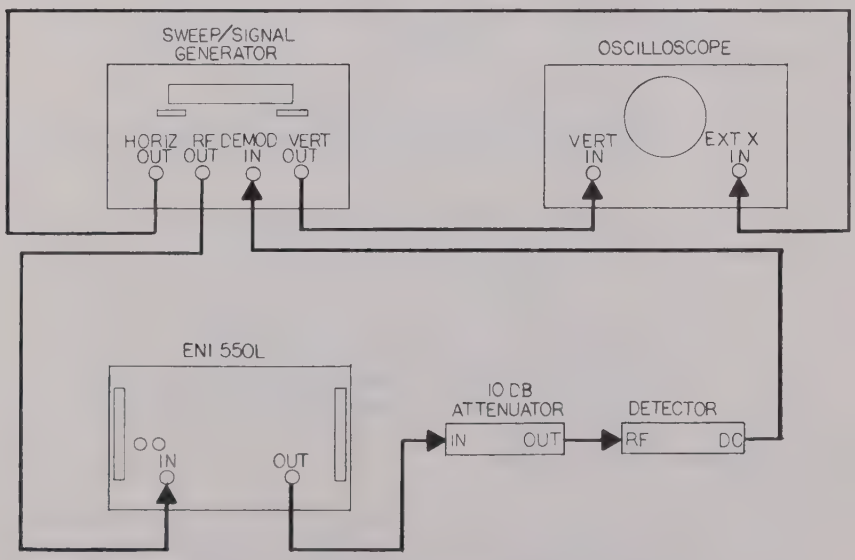


Figure 4-1 Gain Measurement

Connect the equipment as shown in Figure 4-1, then proceed as follows:

(a) Set the oscilloscope to DC, time/CM to Ext. X., and vertical gain to 10MV/CM.

(b) Set the sweep/generator to the S/S mode with the start frequency at 1.5 MHz and the stop frequency at 400 MHz.

(c) Disconnect the ENI 550L from the set-up and connect the sweep/ generator RF output directly to the 10 dB attenuator.

(d) Adjust the output level of the sweep/generator for full vertical deflection on the oscilloscope face.

(e) Calibrate the scope face to show 3 dB in 1 dB steps by attenuating the sweep/generator in 1 dB steps and marking the traces with a grease pencil.

(f) Return sweep/generator output level to full deflection. Rotate the step attenuator on the sweep/generator (CCW) so that the output is reduced by 50 dB.

(g) Reconnect the 550L into the test set-up of Figure 4-1.

(h) Flip the 550L power switch to the "on" position.

(i) Observe the gain versus frequency sweep on the oscilloscope. Adjust the output of sweep/signal so that trace is centered.

1. The average gain should be 50 dB (within 1.5 dB).

2. The gain variation should be within the 3 dB markings as shown on the oscilloscope.

(j) If the gain versus frequency sweep is out of specification, adjust R7 and R17 located on each power supply regulator module (±.5V max) until the sweep observed on the oscilloscope is within the 3 dB markings.

### 4.4.2 Measurement of Harmonics

Equipment required:

(a) Sweep/Signal generator – Wavetek 2001
(b) Two 30 dB Bird Attenuators Model 8322
(c) HP8495A 0-70 dB Step Attenuator

(d) Calorimetric Power Meter – HP434A

(e) Spectrum Analyzer – HP140T Display Unit
HP8554L Spectrum Analyzer
RF Section
HP8552A Spectrum Analyzer
IF Section

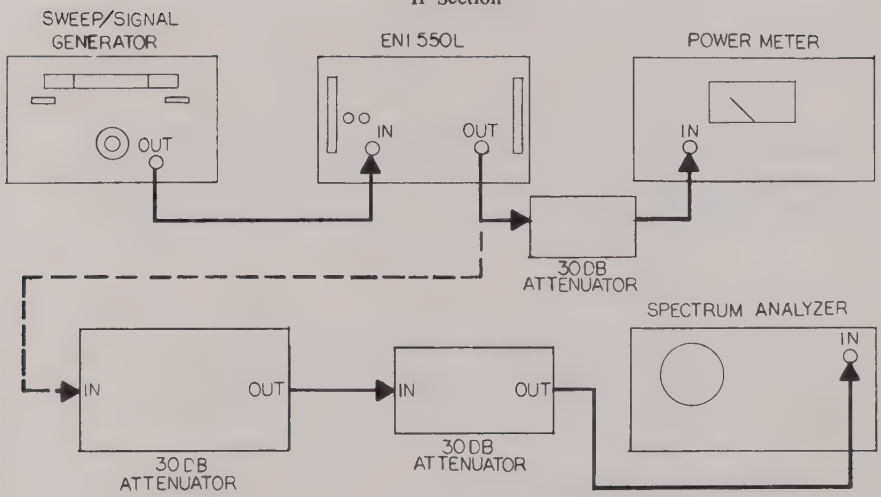


Figure 4-2 Harmonic Measurement

Connect the equipment as shown in Figure 4-2 then proceed as follows:

(a) Adjust the sweep/signal generator at a CW center frequency of 200 MHz for an indicated output of 50 watts on the power meter.

(b) Using the spectrum analyzer, check that the level of the carrier harmonics are less than −23 dB with respect to the carrier.

(c) If the above specification is not met, the 26.4 volt d.c. supplies may be varied up to ±.5V to reduce the harmonic level.

## 4.5 PACKAGING FOR RESHIPMENT

In the event of the equipment being returned for servicing it should be packed in the original shipping carton and packing material. If this is not available wrap the instrument in heavy paper or plastic and place in a rigid outer box of wood, fiberboard or very strong corrugated cardboard. Use ample soft packing to prevent movement. Provide additional support for projecting parts to relieve these of unnecessary shock. Close the carton securely and seal with durable tape. Mark the shipping container FRAGILE to ensure careful handling.

# CHAPTER 5 SCHEMATIC AND PARTS LIST

## 5.1 SCHEMATIC DIAGRAM

A complete schematic diagram appears in figure 5-1.

## 5.2 PARTS LIST

Table 5-1 provides a listing of all electrical parts and those mechanical parts which may be required for replacement. Electrical parts are listed by module number and by reference designations as indicated on the schematic diagrams. The parts list includes a description, part number and manufacturers federal supply code number. Table 5-2 provides a reference glossary of abbreviations used in the parts list.

## 5.3 LIST OF MANUFACTURERS

Table 5-3 provides a correlation of the manufacturers federal supply code numbers used in the parts list with the names and addresses of the manufacturers. If ENI's manufacturer code number (10226) appears, that part must be obtained directly from Electronic Navigation Industries, Inc.

## 5.4 ORDERING REPLACEMENT PARTS

To obtain replacement parts, address order or inquiry to Electronic Navigation Industries, Inc. or its authorized service facility. Identify parts by number as listed in the parts list.

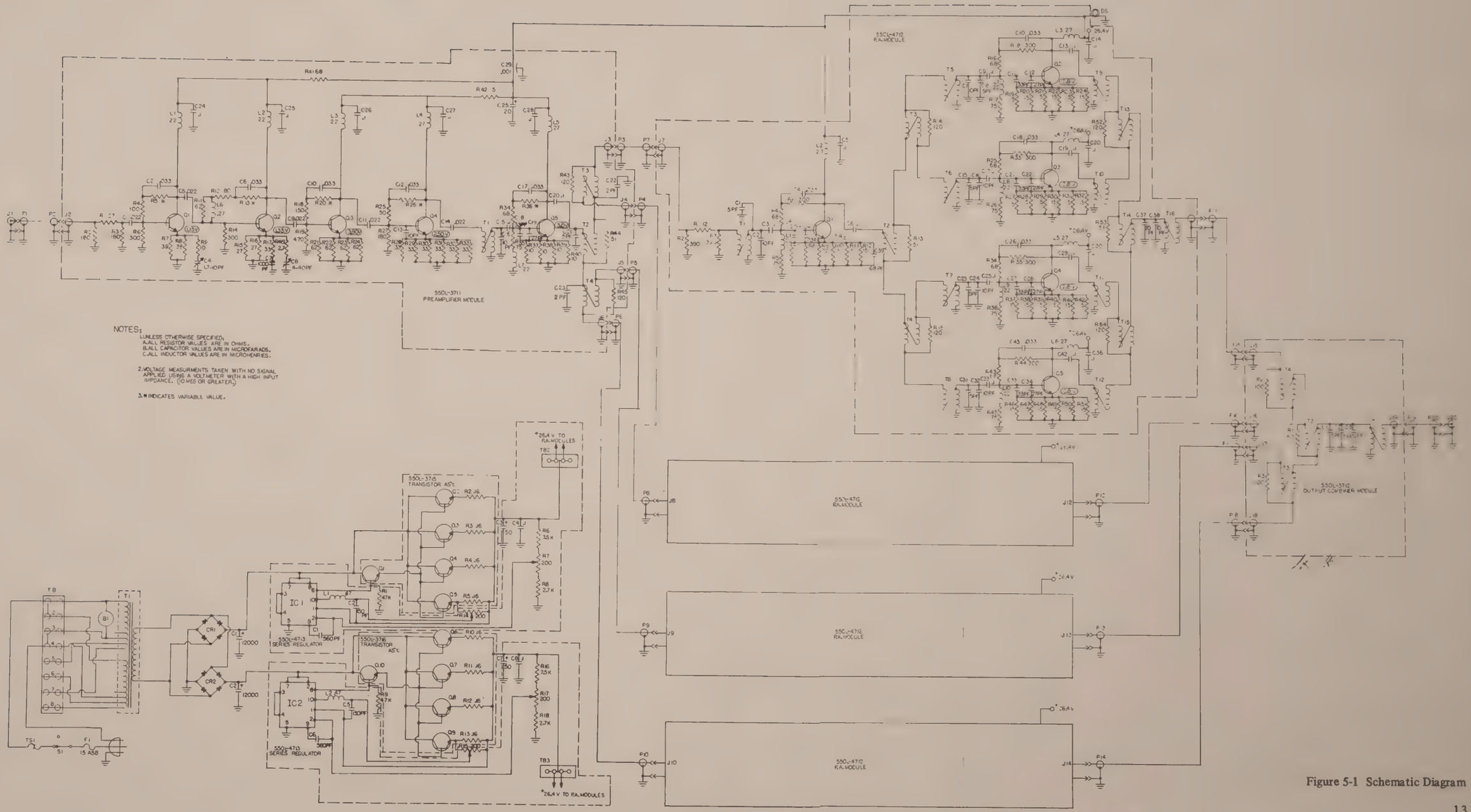


Figure 5-1 Schematic Diagram

## TABLE 5-1. REPLACEMENT PARTS LIST
## MODEL 550L

| REF. DESIGN | DESCRIPTION | MFG. CODE | PART NO. |
|---|---|---|---|
| | POWER DISTRIBUTION ASSEMBLY | | |
| T1 | Transformer, Power | 12715 | AM6205A |
| C1, C2 | Capacitor, 12,000 ufd, 40 VDCW | 56289 | 36D123G040BC2A |
| CR1, CR2 | Bridge Rectifier | 04713 | MDA-3501 |
| Q1, Q10 | Transistor | 10226 | 40312 |
| Q2-Q9 | Transistor | 10226 | ENI-1 |
| A36, R2-R5, R10-R13 | Resistor, .16 ohm, 2W, 5% | 75042 | BWH .16 ohm |
| S1 | Switch | 71785 | 7361K5 |
| DS-1 | Lamp 28 VDC | 08806 | 327 |
| J1 | Type "N" Connector | 13511 | UG-680/U |
| J20 | Connector | 11636 | UG-606 |
| B1 | Fan | 82877 | TN3A2 |
| F1 | Fuse 15 ASB 3AG | 75915 | 313015 |
| XF1 | Fuseholder | 75915 | HKP |
| TS1 | Thermal Switch | 14604 | 2450-088-105 |
| | PREAMPLIFIER ASSEMBLY | 10226 | 550L-3711 |
| A160 | Circuit Board Preamplifier | 10226 | 550L-4711 |
| A160, Q1, Q2 | Transistor | 10226 | ENI-6 |
| A160, Q3 | Transistor | 10226 | ENI-2240 |
| A160, Q4 | Transistor | 10226 | ENI-10A |
| A160, Q5 | Transistor | 10226 | ENI-16 |
| A160, R1, R15, R16 | Resistor, 27 ohm, 1/8W, 5% | 01121 | RC05GF270J |
| A160, R2, R3 | Resistor, 180 ohm, 1/8W, 5% | 01121 | RC05GF181J |
| A160, R7, R8 | Resistor, 39 ohm, 1/8W, 5% | 01121 | RC05GF390J |
| A160, R6, R14 | Resistor, 300 ohm, 1/8W, 5% | 01121 | RC05GF301J |
| A160, R4 | Resistor, 100 ohm, 1/4W, 5% | 01121 | RC07GF101J |
| A160, R9 | Resistor, 10 ohm, 1/4W, 5% | 01121 | RC07GF100J |
| A160, R11, R21-R24 | Resistor, 62 ohm, 1/4W, 5% | 01121 | RC07GF620J |
| A160, R12, R27 | Resistor, 180 ohm, 1/4W, 5% | 01121 | RC07GF181J |
| A160, R17 | Resistor, 33 ohm, 1/4W, 5% | 01121 | RC07GF330J |
| A160, R18 | Resistor, 150 ohm, 1/4W, 5% | 01121 | RC07GF151J |
| A160, R19 | Resistor, 470 ohm, 1/4W, 5% | 01121 | RC07GF471J |
| A160, R35 | Resistor, 75 ohm, 1/4W, 5% | 01121 | RC07GF750J |
| A160, R43, R45 | Resistor, 120 ohm, 1/4W, 5% | 01121 | RC07GF121J |
| A160, R44 | Resistor, 51 ohm, 1/4W, 5% | 01121 | RC07GF510J |
| A160, R28-R33 | Resistor, 33 ohm, 1/4W, 5% Carbon Film | 80031 | Type CR |
| A160, R46 | Resistor, 2.7 ohm, 1/4W, 5% | 01121 | RC07GF2.7J |

| REF. DESIGN | DESCRIPTION | MFG. CODE | PART NO. |
|---|---|---|---|
| | PREAMPLIFIER ASSEMBLY (Cont.) | | |
| A160, R25 | Resistor, 150 ohm, 1W, 5% | 01121 | RC32GF151J |
| A160, R37-R40 | Resistor, 10 ohm, 1W, Metal Oxide | 09021 | M01 |
| A160, R34, R41 | Resistor, 68 ohm, 2W, 5% | 01121 | RC42GF680J |
| A160, R42 | Resistor, 5 ohm, 5W | 12697 | VC5E |
| A160, C1, 5, 9, 11, 14 | Capacitor Chip, .022 ufd | 36346 | C1005C223M5UAH |
| A160, C2, 6, 10, 12, 17 | Capacitor, .033 ufd, 50V | 36346 | C320C333M5U5 |
| A160, C24-C28 | Capacitor, .1 ufd, 50V | 36346 | C330C105M5U5 |
| A160, C4 | Capacitor, 1.7-10 pfd, Trimmer | 91293 | 9301 |
| A160, C8 | Capacitor, 4-40 pfd, Trimmer | 91293 | 9304 |
| A160, C7 | Capacitor, 1,000 pfd, Chip | 10226 | ULA105C102K-1 |
| A160, C13, C16 | Capacitor, 10 pfd | 02799 | DM5CC100A |
| A160, C15, C20 | Chip Capacitor, .1 ufd | 36346 | C1210C124M5UAH |
| A160, C18 | Chip Capacitor, 33 pfd | 29990 | 100B330KP500 |
| A160, C19 | Chip Capacitor, 27 pfd | 29990 | 100B270KP500 |
| A160, C21 | Capacitor, 5 pfd | 02799 | DM5CC050A |
| A160, C22, C23 | Capacitor, 2 pfd | 02799 | DM5CC020A |
| A160, C29 | Capacitor, .001 ufd | 72982 | 357-000X-540-102M |
| A160, C25 | Capacitor, 20 ufd, 50V | 56289 | 500DG-050ED7 |
| A160, L1-L3, L7 | Choke, 22 uhy | 99800 | 1537-44 |
| A160, L4, L5 | Choke, 27 uhy | 99800 | 2890-30 |
| A160, L6 | Choke, .27 uhy | 99800 | 1025-06 |
| A160, T1 | Transformer | 10226 | |
| A160, T2 | Transformer | 10226 | |
| A160, T3, T4 | Transformer | 10226 | |
| J2-J6 | Connector | 10226 | UG-1619 |
| | OUTPUT COMBINER ASSEMBLY | 10226 | 550L-3712 |
| A161 | Board, Output Combiner | 10226 | 550L-4715 |
| A161, R1 | Resistor, 50 ohm, 50W | 13327 | MR-250-875 |
| A161, R2, R3 | Resistor, 100 ohm, 50W | 13327 | MR-250-875 |
| A161, C1, C2 | Capacitor, 5 pfd | 02799 | DM5CC050A |
| A161, C3 | Capacitor, 2 pfd | 02799 | DM5CC020A |
| A161, T1 | Transformer | 10226 | |
| A161, T2 | Transformer | 10226 | |
| A161, T4, T3 | Transformer | 10226 | |
| J15-J18 | Connector | 10226 | 700056 |

| REF. DESIGN | DESCRIPTION | MFG. CODE | PART NO. |
|---|---|---|---|
| | OUTPUT COMBINER ASSEMBLY (Cont.) | | |
| J19 | Connector SMA | 10226 | 142-02-93-001 |
| | P.A. HEATSINK ASSEMBLY | 10226 | 550L-3713/3714 |
| A155 | Circuit Board P A. | 10226 | 550L-4712 |
| J7, J11 | Connector | 98291 | 50-051-0000 |
| A155, Q1-Q5 | Transistor | 10226 | ENI-16 |
| A155, R5, 17, 26, 36, 45 | Resistor, 75 ohm, 1/4W, 5% Carbon Film | 80031 | Type CR |
| A155, R1 | Resistor, 12 ohm, 1/2W, Carbon Film | 80031 | Type CR |
| A155, R2, R3 | Resistor, 390 ohm, 1/2W, 5% Carbon Film | 80031 | Type CR |
| A155, R7, R8, R9 | Resistor, 22 ohm, 1/2W, 5% Carbon Film | 80031 | Type CR |
| A155, R10-R12, R19-R24, R27-R32, R37-R42, R46-R51 | Resistor, 15 ohm, 1/2W, 5% Carbon Film | 80031 | Type CR |
| A155, R4, 16, 25, 34, 43 | Resistor, 68 ohm, 2W, 5% | 01121 | RC42GF680J |
| A155, R6, 18, 33, 35, 44 | Resistor, 300 ohm, 2W, 5% | 01121 | RC42GF301J |
| A155, R13 | Resistor, 51 ohm, 1/2W, 5% Carbon Film | 80031 | Type CR |
| A155, R14, R15 | Resistor, 120 ohm, 1/4W, 5% Carbon Film | 80031 | Type CR |
| A155, R52, R54 | Resistor, 120 ohm, 2W, 5% | 01121 | RC42GF121J |
| A155, R53 | Resistor, 51 ohm, 2W, 5% | 01121 | RC42GF510J |
| A155, C1, 8, 15, 23, 31 | Capacitor, 5 pfd | 02799 | DM5CC050A |
| A155, C2, 7, 16, 24, 32, 37, 38 | Capacitor, 10 pfd | 02799 | DM5CC100A |
| A155, C4, 10, 18, 26, 43 | Capacitor, .033 uf, 50V | 36346 | C320C333M5U5 |
| A155, C5, 14, 20, 30, 36 | Capacitor, .1 uf, 50V | 36346 | C320C104M5U5 |
| A155, C3, 6, 9, 17, 25, 33 | Capacitor, .1 ufd, Chip | 36346 | C1210C124M5UAH |
| A155, C13, 19, 29, 42 | Capacitor, .1 ufd, Chip | 36346 | C1813C104K5UAH |
| A155, C11, 21, 27, 35, 41 | Capacitor, 33 pfd, Chip | 29990 | 100B330KP500 |
| A155, C39 | Capacitor, 68 pfd, Chip | 29990 | 100B680KP500 |

| REF. DESIGN | DESCRIPTION | MFG. CODE | PART NO. |
|---|---|---|---|
| | P.A. HEATSINK ASSEMBLY (Cont.) | | |
| A155, C12, 22, 28, 34, 40 | Capacitor, 27 pfd, Chip | 29990 | 100B270KP500 |
| A155, L1, L7-L10 | Choke, 22 uhy | 99800 | 1537-44 |
| A155, L2-L6 | Choke, 27 uhy | 99800 | 2890-30 |
| A155, T1, T5-T8 | Transformer | 10226 | |
| A155, T9-T12 | Transformer | 10226 | |
| A155, T3, 4, 13, 15 | Transformer | 10226 | |
| A155, T2, T14 | Transformer | 10226 | |
| A155, T6 | Transformer | 10226 | |
| A162 | P.S. REGULATOR | 10226 | 550L-4713 |
| A162, R1 | Resistor, 47K ohm, 1/4W, 5% | 01121 | RC07GF473J |
| A162, R6 | Resistor, 7.5K ohm, 1/2W, 5% | 16299 | MC5 |
| A162, R7, R14 | Resistor, 200 ohm Pot | 32997 | 3386T-1-201 |
| A162, R8 | Resistor, 2.7K ohm, 1/2W | 16299 | HC5 |
| A162, IC1 | Regulator | 49956 | RC723CT |
| A162, C1 | Capacitor, 560 pfd | 09023 | CM05ED561J03 |
| A162, C2 | Capacitor, 150 pfd | 09023 | CM05ED151J03 |
| A162, C3 | Capacitor, 50 ufd, 50V | 56289 | 500D506G050DD7 |
| A162, C4 | Capacitor, .1 ufd | 36346 | C320C104M5U5CA |
| A162, L1 | Choke, .47 uhy | 99800 | 1537-06 |

## TABLE 5-2. GLOSSARY OF ABBREVIATION

| | | | |
|---|---|---|---|
| AMP | AMPERES | PFD | PICOFARAD |
| AMPL | AMPLIFIER | POT | POTENTIOMETER |
| BKT | BRACKET | REF | REFERENCE |
| CAP | CAPACITOR | RES | RESISTOR |
| CER | CERAMIC | SIL | SILICON |
| COMP | COMPOSITION CARBON | UFD | MICROFARADS |
| DPDT | DOUBLE-POLE THROW | UHY | MICROHENRY |
| ELECT | ELECTROLYTIC | V | VOLTS |
| IN | INCHES | VAR | VARIABLE |
| K | KILOHMS | VDCW | DC WORKING VOLTS |
| MTG | MOUNTING | W | WATTS |
| MW | MILLIWATTS | WW | WIRE WOUND |

## TABLE 5-3. LIST OF MANUFACTURERS

| FEDERAL SUPPLY CODE NUMBER | MANUFACTURER | ADDRESS |
|---|---|---|
| 01121 | Allen-Bradley Company | Milwaukee, WI. |
| 02799 | Arco Pacific | Torrance, CA. |
| 04713 | Motorola, Inc. Semiconductors Prod. Div. | Phoenix, AZ. |
| 08806 | General Electric | Cleveland, OH. |
| 09021 | Airco Speer Electronic Components | Bradford, PA. |
| 09023 | Cornell-Dublier Electronics | Sanford, NC. |
| 10226 | ELECTRONIC NAVIGATION INDUSTRIES | Rochester, NY. |
| 11636 | King Electronics, Inc. | Pasadena, CA. |
| 12715 | American Magnetics | Carterville, IL. |
| 13327 | Solitron Devices, Inc. | Port Salerno, FL. |
| 13511 | Amphenol Corporation, Inc. | Los Gatos, CA. |
| 14604 | Elmwood Sensors | Cranton, RI. |
| 16299 | Corning Glass | Raleigh, NC. |
| 12697 | Clarostat MFG. Company | Dover, NH. |
| 29990 | American Technical Ceramics | Huntington Station, NY. |
| 32997 | Bourns, Inc. | Riverside, CA. |
| 49956 | Raytheon | Lexington, MA. |
| 56289 | Sprague Electric Company | North Adams, MA. |
| 71785 | Cinch Div. of TRW | Elk Grove Village, IL. |
| 72982 | Erie Technological Prod. Inc. | Erie, PA. |
| 75042 | IRC Div. of TRW, Inc. | Philadelphia, PA. |
| 75915 | Littlefuse, Inc. | Des Plaines, IL. |
| 80031 | Mepco/Electra, Inc. | Morristown, NJ. |
| 82877 | Rotron, Inc. | Woodstock, NY. |
| 91293 | Johanson MFG. Company | Boonton, NJ. |
| 98291 | Sealectro Corporation | Mamaroneck, NY. |
| 9980 | Delevan Electronics, Inc. | East Aurora, NY. |
| 36346 | Union Carbide (Kemet) | New York, NY. |